

Comprehensive Review of a Neuro Progressive Care Unit

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Abstract

The objective of this comprehensive review is to analyze the current state of the neuro progressive care unit (NPCU) in Hospital A, and evaluate it in comparison to evidence-based practice recommendations of typical patient characteristics and associated nurse staffing and competencies in progressive care units of other hospitals. The current state is defined by the published *NPCU Guidebook* of Hospital A in which patient characteristics and nurse competencies are outlined. The current healthcare environment operates under pressures of limited and expensive resources, constrained budgets, and a looming nursing shortage. Critical care expenditures can be reduced by effectively utilizing progressive care units to provide clinically appropriate, high quality, and cost-effective patient care. Underutilization of a neuro progressive care unit prompts this review. English-language articles published on NPCUs were retrieved utilizing electronic databases and manual screening of titles and abstracts. Rapid critical appraisal and data extraction were completed for the final six articles found. This review features recommendations on (1) inclusion and exclusion criteria for the typical patient population admitted to Hospital A's NPCU, (2) necessary monitoring, appropriate medications, and interventions, and (3) appropriate staffing ratios and nursing competencies. It features evidence to support recommendations that influence an increase in appropriate utilization of Hospital A's NPCU. This will allow patients to be managed at an appropriate level of care outside of the ICU, where acute changes are still able to be identified and managed, readmissions to the ICU are minimized, and critical care costs are decreased.

Keywords: neurosurgical progressive care unit, neuroscience progressive care unit, intermediate care unit, step down unit, admission criteria

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Comprehensive Review of a Neuro Progressive Care Unit

The current healthcare environment operates under pressures of limited and expensive resources, constrained budgets, and a looming nursing shortage. One of the biggest challenges facing healthcare systems today is to provide high quality care for patients with increasing acuity, while controlling costs (Commonwealth Fund, 2017). The Intensive Care Unit (ICU) within a hospital typically cares for the patients with the highest acuity who require high level monitoring, complex interventions, and low staff-to-patient ratios. As patient acuity increases, the expenses within critical care also rise. In 2008, it was estimated that between \$121 and \$263 billion was spent on patients requiring intensive care in the United States, which equates to 17.4% to 39.0% of total hospital costs, and 5.2% to 11.2% of total national spending (Coopersmith et al., 2012). Appropriate utilization of current resources is essential to controlling costs and reducing the financial burden of critical care.

Patients in the ICU typically transfer to a medical unit for continued care prior to discharge from the hospital. At times, patients are critically stable, yet their acuity is too high for nursing management on a medical unit, but too low to warrant ICU services, therefore transition to an intermediate level of care is appropriate (Nates et al., 2016). One strategy to address these issues is the implementation and utilization of progressive care units (PCU). Progressive care units ease the transition from an intensive care setting to a medical unit, improve patient flow, reduce length of stay in ICU beds, and reduce the number of unplanned readmissions to the ICU as a result of increasing acuity or monitoring needs (Enger & Andershed, 2018; Lewis & Latney, 2002). The Society of Critical Care Medicine (SCCM) published guidelines for ICU admission and intermediate care admission for hospitals to ensure appropriate staffing ratios and placement of patients, recognizing the utility of progressive care units (Nates et al., 2016). The American

Association of Critical Care Nurses (AACN) has also contributed to the development of progressive care by establishing core competencies and education requirements for nurses when caring for patients in progressive care environments (American Association of Critical Care Nurses [AACN], 2017).

Problem Statement

Even with these definitions, guidelines, and competency curriculums, the utilization of PCUs are unique to each hospital, which vary depending upon nurse competencies, patient acuity, and available resources. The goals of PCUs are to bridge the gap between ICUs and the medical unit, and to provide clinically appropriate, high quality, and cost-effective patient care. Hospital A currently has five specialized ICUs, but only one PCU that is dedicated to the Neurosciences ICU (NICU), which serves as a bridge between the NICU and neurology unit. This PCU is called the Neuro progressive Care Unit (NPCU). Currently, the NPCU is not being utilized efficiently as evidenced by an average bed occupancy of 67% over a one-year time frame (L. Foglia, personal communication, May 11, 2018). When utilization of a progressive care unit is not optimized, it challenges the ability to maintain nursing competencies, increases poor utilization of ICU beds by increasing patient length of stay in the ICU, and contributes to increasing costs within critical care (Wallace, Angus, Seymour, Barnato, & Kahn, 2014).

Purpose Statement

Progressive care units generally have specific functions within a hospital based on their location, associated ICU, physical layout and resources, and utilization. The objective of this comprehensive review is to analyze the current state of the NPCU in Hospital A and evaluate it in comparison to evidence-based practice recommendations of typical patient characteristics and associated nurse staffing and competencies in progressive care units in an effort to appropriately

utilize current resources. The current state is defined by the published *NPCU Guidebook* of Hospital A in which patient characteristics and nurse competencies are outlined.

This review features recommendations on (1) inclusion and exclusion criteria for the typical patient population admitted to Hospital A's NPCU, (2) necessary monitoring, appropriate medications, and interventions, and (3) appropriate staffing ratios and nursing competencies. Ideally, typical patient characteristics will be identified based upon a review of the literature. This will offer evidence to support an increase in appropriate utilization of NPCUs that will allow patients to be managed at an appropriate level of care outside of the ICU. An NPCU is where acute changes are still able to be identified and responded to, readmissions to the ICU are minimized, and critical care costs are decreased.

Definition of Variables

Neuro Progressive Care Unit

The conceptual definition of a neuro progressive care unit (NPCU) is a unit that provides an intermediate level of care to patients requiring high intensity nursing care or surveillance not met by medical-surgical units but who do not have the acuity or complexity to require admission to an intensive care unit (Stacy, 2011). The AACN defines progressive care on the continuum of critical care, where patients are “moderately stable with less complexity, require moderate resources and require intermittent nursing vigilance or are stable with a high potential for becoming unstable and require an increased intensity of care” (American Association of Critical Care Nurses [AACN] Progressive Care Task Force, 2009, para. 4). The operational definition of an NPCU is a six-bed unit housed within a 550 bed, level one trauma medical center, Hospital A.

Literature Review

Included within this review are the search parameters and search strategy utilized. The literature review also features quality assessment tools and data extraction elements. Finally, search results are discussed, and the theoretical and conceptual framework for the analysis of the review is explained.

Search Parameters

The search strategy involved a review of four electronic databases: Cumulative Index to Nursing and Allied Health Literature (CINAHL), Health Source – Nursing/Academic Edition, Academic Search Ultimate, and ProQuest Central. Keywords included “progressive care” and “progressive care unit”, “intermediate care” and “intermediate care unit”, “step-down”, “admission criteria”, “neuroscience”, and “neurosurgical”. Within each database, the words were searched in trios, such as “progressive care”, “neuroscience”, and “neurosurgical” and then “progressive care” was interchanged with “intermediate care” and the search was reproduced. This search strategy yielded 1,869 articles from CINAHL, 796 from Health Source – Nursing/Academic Edition, five from Academic Search Ultimate, and 1,182 from ProQuest Central. The search was inclusive of English-language articles that were published between 2008 and 2018.

An advanced search was utilized with inclusion criteria of academic journals and full text for CINAHL and ProQuest Central. With this advanced search, the articles were reduced to 1,246 articles. No narrowing criteria were utilized for Health Source – Nursing/Academic Edition or Academic Search Ultimate, resulting in the retrieval of documents that were not relevant. Of the 1,246 articles located, article titles were screened for relevance. Excluding duplicates, a review of the abstracts and relevant titles yielded four articles that met inclusion

criteria relating specifically to “neurosurgical” or “neuroscience” PCUs. Research and non-research articles were included. Upon review of the four articles, ancestral searching revealed two additional articles of relevance and one evidence-based practice guideline. The evidence-based practice guideline was found to have a more recent version, which is included in this review.

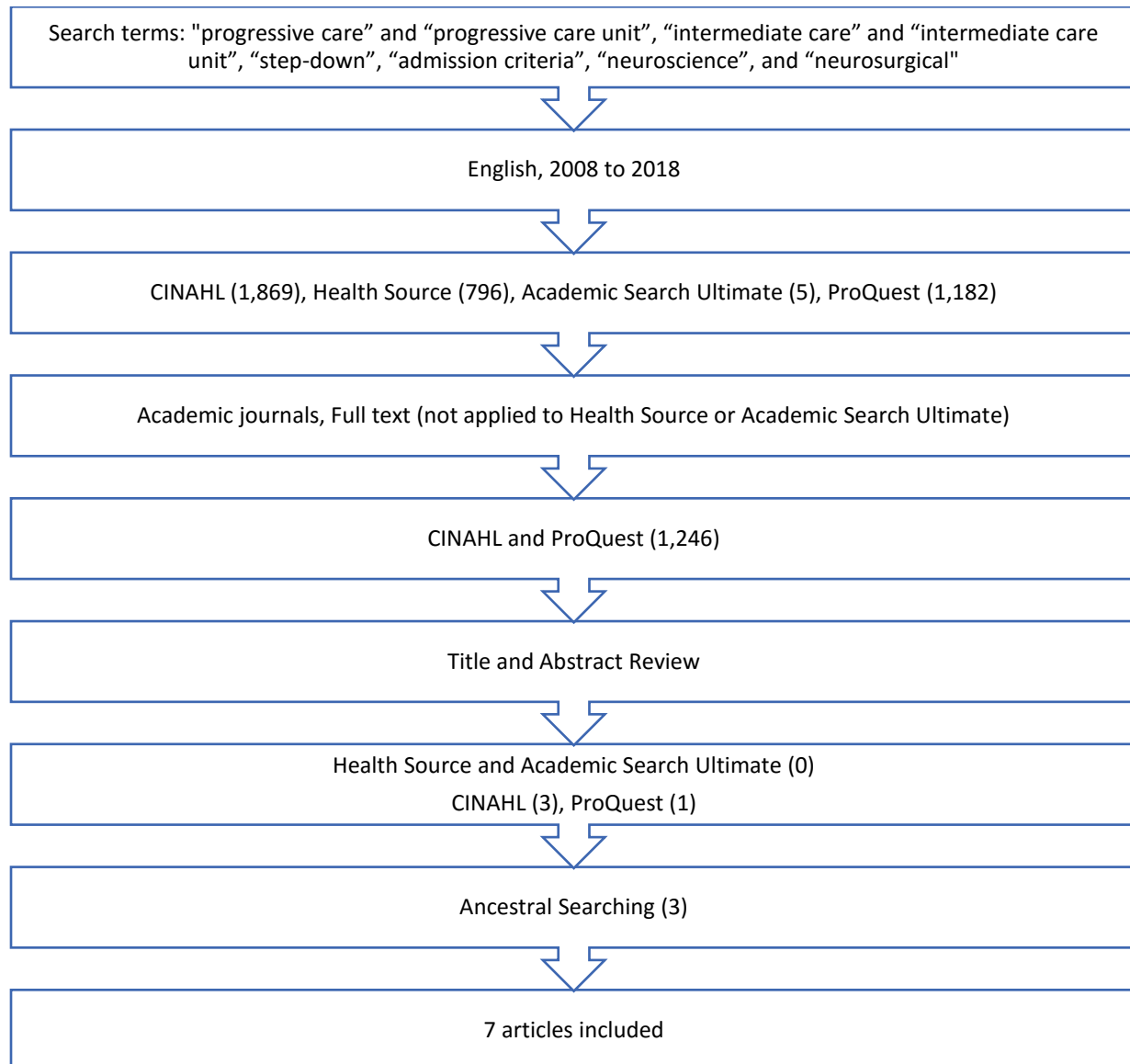


Figure 1. Search strategy and retrieval process.

Quality Assessment

The final six articles and one guideline were reviewed utilizing rapid critical appraisal (RCA) assessment tools when appropriate (see Appendix A through D for the quality assessment tools). Of the seven articles comprising this review, one was an evidence-based guideline, four were non-research studies, and two were research studies. The RCA tools selected facilitate the assessment of evidence-based practice guidelines, cohort studies, descriptive studies, and qualitative studies. Each RCA tool features exclusive criteria that can be checked with respect to whether the criteria are met or not; however, no scoring scale is present. Validity of results, interpretation of results and reliability, and applicability to the identified patient population were each questioned. The author reviewed and completed an RCA on each article prior to data extraction.

Data Extraction

The following are data elements that were mined from the seven articles: author, journal, purpose, unit name and structure, design and level of evidence, patient population, monitoring, continuous intravenous (IV) infusions and medications, study findings, and quality of evidence. Appendix E features a summary of the data extraction.

Search Results

Five articles feature explorations of PCUs in specific hospital settings, one features an investigation of the typical patient population of PCUs without regards to an exclusive setting, and one article provides guidelines for PCUs in a general. Two articles were authored by physicians and published in medical journals, while the additional five articles were authored by registered nurses. Three articles feature an assessment of the implementation of a progressive care model, six specifically address a patient population, and four include definitions of

monitoring capabilities or requirements beyond telemetry. Of the seven articles, four feature discussions of the utilization of medications and continuous IV infusions. Five articles are concerned with PCUs within various state hospital systems. In total, there were 545 patients that participated in two included research studies, and 17 progressive care units included within this review of all articles combined. Between the 17 units and seven research and non-research articles, 16 unique names for PCUs were aggregated (see Table 1). See Appendix E for characteristics of the included studies.

Table 1

Synonyms for Progressive Care Units (PCUs)

Intermediate care unit (IMCU)	Neuro progressive care unit (NPCU)
Transitional care unit	Dedicated stroke unit
Step-down unit	Neuroscience intermediate unit (NIU)
Telemetry unit	Neurosurgical close observation room
Subacute care	Intermediate intensive care unit
Definitive observation unit	Postinterventional unit
Direct observation unit	Clinical decision unit
Intermediate medical unit (high-medium), level 2a	High dependency units

Note. Adapted from Nates et al., 2016; "The Value of a Progressive Care Environment for Neurosurgical Patients" by M.A. Schneider and M.A. Pomidor, 2014, *Journal of Neuroscience Nursing*, (46)5, pp. 306-311; Stacy, 2011.

Theoretical and Conceptual Framework

Within the seven articles, one model and various guidelines were utilized to guide progressive care unit structure, admission criteria, patient population, and nurse competencies. Objectively defining patient characteristics that belong in an ICU, NPCU, and an acute care neurology unit is essential. The analysis of this review is organized by characteristics of included studies and the Synergy Model. The Synergy Model identifies the importance of the match between patient characteristics and nurse competencies. As defined by the AACN, the Synergy Model was used in two studies for its ability to describe the ideal pairing of patient

characteristics and nurse competencies for optimal patient outcomes (American Association of Critical Care Nursing [AACN], n.d.). In the model, patient characteristics are scored along a continuum indicating acuity and assisting in placement of patients when correlated with nursing competencies. These characteristics referenced in the Synergy Model are resiliency, vulnerability, stability, complexity, resource availability, participation in care, participation in decision-making, and predictability (AACN, n.d.). Synergy is said to occur when the requirements of the patient align to the strengths of the nurse. The progressive care nurse is skilled in clinical judgement, advocacy, surveillance, communication, collaboration, and education (AACN, 2010). The Synergy Model is the method utilized to identify characteristics of appropriate patients for the NPCU of Hospital A, and the respective nurse competencies required to care for these patients.

Methods

This is a comprehensive review of patient characteristics and nurse competencies that are defined within the *NPCU Guidebook* of Hospital A. These patient characteristics and nurse competencies were sorted into a table for comparison of best practices and evidence found within a review of literature (see Appendix F). Utilization of the Synergy Model steered the comparing and contrasting of patient characteristics and nurse competencies; this in turn guided the formulation of recommendations that may influence an increase in appropriate utilization of Hospital A's NPCU. For example, if a patient requires mechanical ventilation via a tracheostomy, it is only appropriate that the patient receives care in a setting equipped with resources for mechanical ventilation and continuous pulse oximetry monitoring, with nurses who are competent in care of patients with tracheostomies, and the assessment of the ventilator-dependent patient. The patient characteristics inform the required nurse competencies; both are

reliant on the hospital's resources and care setting, allowing for synergistic patient care.

Recommendations address (1) inclusion and exclusion criteria for the typical patient population admitted to Hospital A's NPCU, (2) necessary monitoring, appropriate medications, and interventions, and (3) appropriate staffing ratios and nursing competencies.

Results

The results indicate patient characteristics and nurse competencies as referenced in the review of literature and the *NPCU Guidebook* of Hospital A. A list of competencies for progressive care nursing is identified by the AACN and referenced in three articles. Many of the characteristics and competencies identified by the review of literature are generalizable not only to NPCUs, but to general progressive care units as well. For a summary of publication-specific descriptions of appropriate patient populations, monitoring capabilities, and medical infusions utilized in the NPCU setting that form patient characteristics and recommendations, see Appendix F. Also, see Appendix F for a summary of associated nurse competencies and recommendations.

Cardiac Monitoring and Infusions

Competencies for progressive care nursing include cardiac, hemodynamic, and oxygen saturation monitoring, and intravenous medication administration and titration abilities (Harding, 2009; Schneider & Pomidor, 2014; Stacy, 2011). Five studies include telemetry monitoring as a core competency (Harding, 2009; Nadolski, Pheraby, & Ramos, 2017; Nates et al., 2016; Schneider & Pomidor, 2014; Stacy, 2011). Telemetry monitoring is reflected in the *NPCU Guidebook* (2018), as upon admission, all patients are placed on a monitor upon admission capable of capturing cardiac or telemetry monitoring. While cardiac and telemetry monitoring are suggested by the literature review, the NPCU of Hospital A only requires that nurses are

competent in cardiac monitoring (Hospital A, 2018). When patients require telemetry monitoring, the nurse is responsible for coordinating monitoring by a telemetry technician (Hospital A, 2018).

Arterial blood pressure monitoring is supported by two articles (Nadolski, Pheraby, & Ramos, 2017; Stacy, 2011) and explicitly excluded by four publications (Alkhachroum, Benth, Chari, Kulhari, & Xiong, 2017; Harding, 2009; Schneider & Pomidor, 2014; Tisnado, 2009). In the two articles that include arterial blood pressure monitoring, cardiac and vasoactive intravenous medications are also involved, such as nicardipine, labetalol, diltiazem, and esmolol. The Society of Critical Care Medicine (SCCM) and Alkhachroum et al. (2017) state that intravenous drips can be utilized for blood pressure control, exclusive of vasopressors, and only inclusive of vasodilators and antiarrhythmics. To be specific, the AACN supports invasive arterial pressure monitoring, and noninvasive hemodynamic pressure monitoring (Stacy, 2011). According to the *NPCU Guidebook* (2018), arterial lines are excluded from nurse competencies; however, titration of nicardipine, insulin, hypertonic saline for sodium management, and sliding scale supplements are listed as competencies for the registered nurse.

The SCCM also defines interventions performed in progressive care units, referenced as intermediate medical units and step-down units, that by default nurses must be competent to perform; these competencies include titration of intravenous fluids, titration of vasodilators, and titration of antiarrhythmic substances (Nates et al., 2016). The guideline is found historically within three publications (Harding, 2009; Schneider & Pomidor, 2014; Stacy, 2011).

Respiratory Monitoring and Abilities

The SCCM indicates that noninvasive ventilation and patients that do not wish to be resuscitated or intubated meet admission criteria for PCUs (Nates et al., 2016). In three articles,

the exclusion of invasive mechanical ventilation in NPCUs is specifically discussed (Alkhachroum et al., 2017; Harding, 2009; Nates et al., 2016), while one publication indicates that patients that have been recently extubated or are being weaned off ventilation are appropriate for NPCU admission, as long as continuous pulse oximetry monitoring is available (Stacy, 2011). The *NPCU Guidebook* (2018) features clear guidelines for respiratory monitoring; inclusion criteria include patients requiring continuous pulse oximetry monitoring, and exclusion criteria include patients with endotracheal tubes. Invasive mechanical ventilation is largely excluded from the NPCU of Hospital A; however, “patients requiring a ventilator only as part of spinal cord ventilator bridge process” can be admitted to the NPCU (Hospital A, 2018, p. 4). These patients are not staffed by NPCU nurses, and ventilator management is not a required competency of the NPCU nurse; these patients are staffed in partnership with spinal cord nurses.

Neurological Assessments

According to the SCCM, the type of patients that belong in a progressive care unit are “unstable patients who need nursing interventions, laboratory workup, and/or monitoring every two to four hours” (Nates et al., 2016, p. 1561). In the literature, frequent neurological assessments are emphasized (Schneider & Pomidor, 2014; Stacy, 2011; Tisnado, 2009), ranging from two- to four-hour neurological assessments (Alkhachroum et al., 2017; Nates et al., 2016) to assessments every hour (Nadolski, Pheraby, & Ramos, 2017). The *NPCU Guidebook* features a patient population “requiring vital sign or neuro checks hourly for more than eight consecutive hours” (Hospital A, 2018, p. 3).

Diagnoses and Interventions

Stroke. Ischemic and hemorrhagic strokes are included specifically in two articles and the AACN textbook on progressive care nursing. Alkhachroum et al. (2017) have defined NPCU admission criteria specifically for patients with intracerebral hemorrhage (ICH), including an ICH volume less than 20 cubic centimeters, no evidence of intraventricular hemorrhage, no respiratory failure, a Glasgow Coma Score greater than or equal to 12, systolic blood pressures less than 200 millimeters of mercury. The associated monitoring for this NPCU is a 1:4 nurse-patient ratio, excluding advanced monitoring (arterial line, central venous pressure [CVP], and intracranial pressure [ICP] monitoring), and requiring every two-hour neurological assessments and vital signs (Alkhachroum et al., 2017). Subarachnoid hemorrhage (SAH) post-bleed day five are included in the NPCU of Nadolski, Pheraby, and Ramos (2017).

Chulay and Burns (2010) reference within the AACN textbook, *Essentials of Progressive Care Nursing*, care of patients with either ischemic or hemorrhagic stroke. A timeline for admission to progressive care is not identified for ischemic or hemorrhagic strokes; however, patients who suffer from a subarachnoid hemorrhage (SAH) do have a timeline featured. Those with a SAH are initially admitted to the ICU for management after aneurysm clipping or endovascular treatment; then “if the neurological examination remains stable after 24 to 48 hours, at some institutions the patient may be transferred to a specialized neuro progressive care unit to be monitored for vasospasm and other complications” (Chulay & Burns, 2010, p. 442). The *NPCU Guidebook* of Hospital A features those with ischemic strokes who are considered stable (12 hours after administration of tissue plasminogen activator [tPA]), and those with a stable SAH (Hospital A, 2018, p. 19). As stated in by the *NPCU Guidebook* (2018), stability is defined by a combination of a Hunt and Hess score and a Fischer Grade score that together

determine the severity of a SAH (p. 19). Currently, patients are eligible to transfer from the ICU to the NPCU at Hospital A seven to 10 days post admission “if there is no vasospasm, blood pressure is under control, and the patient has acceptable transcranial doppler pulses” (Hospital A, 2018, p. 19).

Drains. The patient population of Nadolski, Pheraby, and Ramos (2017) includes ICP, external ventricular drain (EVD), and CVP monitoring, as well as hourly neurology (neuro) checks. Lumbar drains and EVDs are supported by three publications (Nadolski, Pheraby, & Ramos, 2017; Schneider & Pomidor, 2014; Tisnado, 2009). However, EVDs are excluded by Alkhachroum et al. (2017). The *NPCU Guidebook* features utilization of lumbar drains for intermittent CSF drainage, and subdural drains in the form of Jackson-Pratt (JP) drains (Hospital A, 2018, pp. 13-17). Hospital A’s guidebook clearly features exclusion criteria for admission into the NPCU including patients requiring ICP monitoring, and patients requiring an EVD (NPCU Guidebook, 2018, p. 4).

Surgery. Admission to the NPCU for postoperative craniotomy patients and patients who are postoperative from a transsphenoidal intervention are supported by three publications (Nadolski, Pheraby, & Ramos, 2017; Schneider & Pomidor, 2014; Tisnado, 2009). Hospital A’s *NPCU Guidebook* (2018) features admission criteria for patients post cranioplasty, and patients who have had a pituitary tumor resection (2018, pp. 18, 21). These patients require increased vital sign monitoring and neuro checks, but no invasive monitoring. Vital signs and neuro checks are at minimum hourly, but every fifteen minutes should vasoactive medications be utilized. Pituitary tumor resections require nurses who are vigilant in assessment and treatment of potential complications such as diabetes insipidus and the administration of vasopressin.

Nurses at Hospital A are required to be competent in the hourly monitoring of a patient's intake and output, vital signs, neuro checks, and cerebral spinal fluid leaks (Hospital A, 2018, p. 21).

In addition, deep brain stimulators, bypass grafting for moyamoya disease, and microvascular decompression are interventions that patients can receive while admitted in an NPCU, as reported by Tisnado (2009), requiring no invasive monitoring. Deep brain stimulators and patients post ventriculoperitoneal shunt (VP shunt) placement are included in the *NPCU Guidebook*. However, specific interventions such as bypass grafts and microvascular decompression are not (Hospital A, 2018, p. 12). Patients who have their shunts externalized (EVDs) are currently not appropriate for Hospital A's NPCU. Conversely, once internalized, patients with these shunts can be cared for in the NPCU while nurses monitor the craniotomy site and anticipate discharge within 24 hours (Hospital A, 2018, p. 16).

Nurse Ratios

The pairing of nurses to patients is dependent upon the patient characteristics and the nurse competencies. The literature shows a 1:3 nurse-patient ratio as the recommended staffing for safe and effective patient care within PCUs (Harding, 2009; Nadolski, Britt, & Ramos, 2017; Nates et al., 2016; Schneider & Pomidor, 2014). The SCCM guideline recommends a nurse-patient ratio of no greater than 1:3 for "unstable patients who need nursing interventions, laboratory workup, and/or monitoring every two to four hours" (Nates et al., 2016, p. 1561). This nurse-patient ratio is reflected in the *NPCU Guidebook*; the nurse-patient ratio is 1:3 at maximum, indicating that "one nurse may take all three NPCU patients when appropriate" (Hospital A, 2018).

Discussion

The results of this comprehensive review indicate that the typical characteristics of patients in neuro progressive care units are inherently dependent upon nurse competencies, unit structure, monitoring capabilities, and resources available. In utilizing the Synergy Model, patient characteristics for NPCUs are defined jointly by the competencies of the nursing staff and admission recommendations of the SCCM and AACN. Specifically, for stroke patients, according to the American Heart Association/American Stroke Association (AHA/ASA) guidelines, there are “no clinical criteria for whom ICH patients can be safely monitored in step-down unit...as oppose to intensive care unit” (Alkhachroum et al., 2017, p. 14). This is unchanged from *Guidelines for the Management of Spontaneous Intracerebral Hemorrhage*, by Hemphill et al. in 2015. However, the text from AACN on *Essentials of Progressive Care Nursing* features nursing management of patients with ischemic or hemorrhagic strokes, and specifically indicates a window of 24 to 48 hours post-intervention for patients with subarachnoid hemorrhages who may be appropriate for progressive care (Chulay & Burns, 2010). If an NPCU is staffed with nurses who have strong competencies in stroke management and neurological assessment skills, and the patient characteristics require those competencies, then an NPCU is justified in comparison to an ICU setting.

Within the SCCM guideline, step-down units are negatively referenced; they are alluded to as one of many discharge strategies to reduce length of stay in ICU, but they are a strategy without validated effectiveness likely the result of a paucity of data related to a lack of research (Nates et al., 2016). The literature review reveals a great variability in PCU capabilities regarding monitoring, medications, nurse competencies, and nurse-patient ratios. Nurse-patient ratios are defined in five publications; however, these ratios are dependent upon the capabilities

of each unique unit structure and acuity of the patients. Only three studies within this review feature a Level of Evidence of III or greater according to the appraisal process. Five articles did not have any statistical analysis, also limiting the numerical analysis of the conclusions. The collection of included publications was not appropriate for a meta-analysis.

Recommendations

The review of literature reveals the variability in typical patient characteristics of patients admitted to NPCUs and suggests the need for more research to establish a consensus of criteria based on necessary monitoring, appropriate medications, and staffing required in neurology-specific progressive care units. It is apparent from this review of the literature that NPCUs are being utilized in a multitude of formats, with various capabilities, structures, patient populations, and nurse competencies. The paucity of publications on NPCUs indicates that more research needs to be done to validate the effectiveness of NPCUs for cost containment and patient flow. Ideally, the formation of an NPCU model utilizing the relevant research will support an increase in appropriate utilization of NPCUs that will allow patients to be managed at an appropriate level of care outside of the ICU.

Hospital A's NPCU

The broad purpose of the NPCU within Hospital A is to provide an intermediate level of care to patients who require close monitoring but are not critical enough to require ICU level of care. Nurse competencies must be synergistic with patient characteristics and the hospital's resources to allow for optimal patient care and outcomes. It is recommended that Hospital A's NPCU staff develop an understanding of the diagnoses and interventions that their patients experience along the critical care spectrum, from admission to discharge. Providing intermediate level of care requires these nurses to be competent in assessment and monitoring of patients

nearing the level of ICU care, as well as approaching the stability required to transfer to a medical unit. In this project, the Synergy Model was utilized to provide a unique definition of what this NPCU is capable of, in terms of the patient characteristics that are included, and the nurse competencies that are required.

An overarching limitation is the structural make-up of Hospital A's NPCU. A six-bed unit, housed within the general neurosciences medicine unit, is the arena. All rooms are equipped with monitors that allow for continuous cardiac or telemetry monitoring, continuous pulse oximetry, and frequent noninvasive blood pressure monitoring (Hospital A, 2018, p. 4). Appendix F features a summary of recommendations on (1) inclusion and exclusion criteria for the typical patient population admitted to Hospital A's NPCU, (2) necessary monitoring, appropriate medications, and diagnoses/interventions, and (3) appropriate staffing ratios. Nurse competencies are included in the recommendations, and are reflective of included patient diagnoses and interventions, monitoring, and infusions.

Inclusion criteria. Acknowledging the resources available in Hospital A's NPCU, it is recommended that the NPCU of Hospital A continue to include patients who have had ischemic or hemorrhagic strokes, a subarachnoid hemorrhage, IR procedure, craniotomy, or VP shunt placed. The assessment, monitoring, and management of patients with subdural drains and lumbar drains are also recommended to continue. New inclusion diagnoses are recommended after this comprehensive review, including patients with lumbar drains that involve transducing or continuous draining, and patients with unstable neurological disorders. With these additions, new nurse competencies must be added to reflect the care provided to patients.

It is recommended that the *NPCU Guidebook* be adjusted to feature confirmation of current competencies in assessment and management of drains, and that new competencies be

added to reflect a nurse's ability to monitor transduced and continuous lumbar drains. Regarding the addition of patients who have unstable neurological disorders to the *NPCU Guidebook*, the Synergy Model would suggest that nurse competencies be added as well. It is recommended that nurses obtain additional competencies in assessment, monitoring, and management of patients with unstable neurological disorders, such as Guillian-Barre, Multiple Sclerosis, Myasthenia Gravis, and seizure disorders.

Monitoring. The addition of patients with EVDs is also recommended; with that addition, the competencies for monitoring and management of EVDs, associated ICP monitoring, and hypertonic saline infusions for ICP management are recommended. After reviewing the literature, and guidelines from the AACN and SCCM, it is recommended that patients requiring invasive blood pressure monitoring, or arterial lines, be included in the NPCU, and that new nurse competencies are reflective of this. With the addition of arterial lines, the titration of nicardipine is facilitated as blood pressure can be monitored more closely than previously with only noninvasive techniques. Vasopressors should continue to be excluded despite the addition of invasive blood pressure monitoring.

Staffing ratios. As indicated by the Synergy Model, an appropriate nurse to patient ratio is dependent upon the patient characteristics and the nurse competencies. A discussion of nurse to patient ratios is not referenced specifically by the AACN guidelines, or within the AACN textbook, *Essentials of Progressive Care Nursing* by Chulay and Burns (2010). However, both the review of literature and SCCM guideline confirm Hospital A's current 1:3 nurse-patient ratio as the recommended staffing for safe and effective patient care within Hospital A's NPCU (Harding, 2009; Nadolski, Britt, & Ramos, 2017; Nates et al., 2016; Schneider & Pomidor, 2014). In general, this 1:3 ratio remains appropriate and should be

maintained at Hospital A. Yet, considering the recommendations for new patient characteristics and nurse competencies, a ratio of 1:2 should be considered pending patient acuity and presence of drains, infusions, or invasive blood pressure monitoring.

Conclusion

Initial management of patients with neurological disorders and injuries takes place in the ICU and is focused on optimizing functional recovery and minimizing secondary brain injury. This review shows that NPCUs are clearly the environment in which acute changes are identified and responded to, admissions to the ICU are minimized, and patients are cared for at an increased acuity than in general wards. Despite the variability of NPCU utilization in the publications of this review, NPCUs in their various formats are operating as safe areas for patients who do not meet ICU admission criteria, yet they are too acute for general wards. Hospital A's NPCU designates specific progressive care beds within a medical unit and educates nurses on how to successfully care for these patients. Hospital A's NPCU may increase in utilization as neurologically stable, yet complex patients are carefully assessed and managed in a unique progressive care environment.

While more research is being conducted, it is recommended that NPCUs adhere to the Synergy Model to ensure that each unique NPCU patient characteristic mirrors nurse competencies, provider abilities, and unit capabilities for optimal patient outcomes. This will allow patients to be managed at an appropriate level of care outside of the ICU, where acute changes are still able to be identified and responded to, readmissions to the ICU are minimized, and critical care costs are decreased. To validate positive patient outcomes, recommendation for additional review of NPCUs is warranted by the review of the literature.

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Appendix A

Rapid Critical Appraisal of Qualitative Evidence

1) Are the results of the study valid (i.e., trustworthy and credible)?

a) How were study participants chosen? _____

b) How were accuracy and completeness of data assured? _____

c) How plausible/believable are the results?

i) Are implications of the research stated? Yes No Unknown

(1) May new insights increase sensitivity to others' needs?

(2) May understandings enhance situational competence?

d) What is the effect on the reader?

(1) Are results plausible and believable? Yes No Unknown

(2) Is the reader imaginatively drawn into the experience? Yes No Unknown

2) What were the results?

a) Does the research approach fit the purpose of the study? Yes No Unknown

i) How does the researcher identify the study approach? Yes No Unknown

(1) Are language and concepts consistent with the approach? Yes No Unknown

(2) Are data collection and analysis techniques appropriate? Yes No Unknown

ii) Is the significance/importance of the study explicit? Yes No Unknown

(1) Does review of the literature support a need for the study? Yes No Unknown

(2) What is the study's potential contribution? _____

iii) Is the sampling strategy clear and guided by study needs? Yes No Unknown

(1) Does the researcher control selection of the sample? Yes No Unknown

(2) Do sample composition and size reflect study needs? Yes No Unknown

b) Is the phenomenon (human experience) clearly identified?

i) Are data collection procedures clear? Yes No Unknown

(1) Are sources and means of verifying data explicit? Yes No Unknown

(2) Are researcher roles and activities explained? Yes No Unknown

ii) Are data analysis procedures described? Yes No Unknown

(1) Does analysis guide direction of sampling and when it ends? Yes No Unknown

(2) Are data management processes described? Yes No Unknown

c) What are the reported results (description or interpretation)?

i) How are specific findings presented? _____

(1) Is presentation logical, consistent, and easy to follow? Yes No Unknown

(2) Do quotes fit the findings they are intended to illustrate? Yes No Unknown

ii) How are overall results presented? _____

(1) Are meanings derived from data described in context? Yes No Unknown

(2) Does the writing effectively promote understanding? Yes No Unknown

3) Will the results help me in caring for my patients?

a) Are the results relevant to persons in similar situations? Yes No Unknown

b) Are the results relevant to patient values and/or circumstances? Yes No Unknown

c) How may the results be applied in clinical practice? _____

Appendix B

Rapid Critical Appraisal Checklist for Descriptive Studies**VALIDITY****Are the results of the study valid?**

- | | | |
|--|-----|----|
| • Were study/survey methods appropriate for the question? | Yes | No |
| • Was sampling method appropriate for the research question? | Yes | No |
| • Was sample size implications on study results discussed? | Yes | No |
| • Were variables studied appropriate for the question? | Yes | No |
| ○ Dependent variables are: | | |
| ○ Independent (outcome) variables are: | | |
| • Were outcomes appropriate for the question? | Yes | No |
| • Were valid and reliable instruments used to measure outcomes? | Yes | No |
| • Were the chosen measures appropriate for study outcomes? | Yes | No |
| • Were outcomes clearly described? | Yes | No |
| • Did investigators and/or funding agencies declare freedom from conflict of interest? | Yes | No |

RELIABILITY**What are the results?**

- | | | |
|---|-----|----|
| • What were the main results of the study? | | |
| ○ Was there statistical significance? Explain | | |
| ○ Was there clinical significance? Explain | | |
| • Were safety concerns, including adverse events and risk/benefit, described? | Yes | No |

APPLICABILITY**Will the results help me in caring for my patients?**

- | | | |
|---|-----|----|
| • Are the results applicable to my patient population? | Yes | No |
| • Will my patients' and families' values and beliefs be supported by the knowledge gained from the study? | Yes | No |

Reflection Prompts: Would you use the study results in your practice to make a difference in patient outcomes?

- If yes, how?
- If yes, why?
- If no, why not?

Additional Comments/Reflections:**Recommendation for article use within a body of evidence:**

Appendix C

Rapid Critical Appraisal of Evidence-based Guidelines**CREDIBILITY**

1) Who were the guideline developers?	<hr/>		
2) Were the developers representative of key stakeholders in this specialty (interdisciplinary)?	Yes	No	Unknown
3) Who funded the guideline development?	<hr/>		
4) Were any of the guidelines developers funded researchers of the reviewed studies?	Yes	No	Unknown
5) Did the team have a valid development strategy?	Yes	No	Unknown
6) Was an explicit (how decisions were made), sensible, and impartial process used to identify, select, and combine evidence?	Yes	No	Unknown
7) Did its developers carry out a comprehensive, reproducible literature review within the past 12 months of its publication/revision?	Yes	No	Unknown
8) Were all important options and outcomes considered?	Yes	No	Unknown
9) Is each recommendation in the guideline tagged by the level/strength of evidence upon which it is based and linked with the scientific evidence?	Yes	No	Unknown
10) Do the guidelines make explicit recommendations (reflecting value judgments about outcomes)?	Yes	No	Unknown
11) Has the guideline been subjected to peer review and testing?	Yes	No	Unknown

APPLICABILITY/GENERALIZABILITY

12) Is the intent of use provided (e.g. national, regional, local)?	Yes	No	Unknown
13) Are the recommendations clinically relevant?	Yes	No	Unknown
14) Will the recommendations help me in caring for my patients?	Yes	No	Unknown
15) Are the recommendations practical/feasible (e.g., resources - people and equipment- available)?	Yes	No	Unknown
16) Are the recommendations a major variation from current practice?	Yes	No	Unknown
17) Can the outcomes be measured through standard care?	Yes	No	Unknown

Modified from Slutsky, J. (2005). *Using Evidence-based Guidelines: Tools for Improving Practice*, In B.M. Melnyk & E. Fineout-Overholt (Eds). *Evidence-Based Practice in Nursing & Healthcare. A Guide to Best Practice*. (pp. 221-236). Philadelphia: Lippincott, Williams & Wilkins. This form may be used for educational, practice change & research purposes without permission.

Appendix D

Rapid Critical Appraisal Questions for Cohort Studies

1. Are the results of the study valid?

- | | | | |
|--|-----|----|---------|
| a. Was there a representative and well defined sample of patients at a similar point in the course of the disease? | Yes | No | Unknown |
| b. Was follow up sufficiently long and complete? | Yes | No | Unknown |
| c. Were objective and unbiased outcome criteria used? | Yes | No | Unknown |
| d. Did the analysis adjust for important prognostic risk factors and confounding variables? | Yes | No | Unknown |

2. What are the results?

- | | |
|---|-------|
| a. What is the magnitude of the relationship between predictors (i.e., prognostic indicators) and targeted outcome? | _____ |
| b. How likely is the outcome event(s) in a specified period of time? | _____ |
| c. How precise are the study estimates? | _____ |

3. Will the results help me in caring for my patients?

- | | | | |
|---|-----|----|---------|
| a. Were the study patients similar to my own? | Yes | No | Unknown |
| b. Will the results lead directly to selecting or avoiding therapy? | Yes | No | Unknown |
| c. Are the results useful for reassuring or counseling patients? | Yes | No | Unknown |

Appendix E: Evidence Table

Table E1
Evidence Table – Characteristics of Included Articles

Author (s) (year); journal	Purpose	Unit name and structure	Design and level of evidence	Patient population	Monitoring capabilities	Drips and medications	Quality of Evidence	Statistics or implications
Nadolski, C., Pheraby, B., & Ramos, L. (2017); Journal of Neuroscience Nursing	To determine the ideal staffing for a neuroscience intermediate care unit; to justify a staffing increase from 1:4 and 1:5, to 1:3	Neuroscience intermediate unit (NIU), 23- bed unit Sample: 12 similar units and 1 NIU 13 of 14 units staff 1:3 nurse-patient ratio	Mixed methodology Quantitative retrospective chart review for InterQual data from 9832 patient days Interviews of 20 nurse managers III	Postoperative craniotomy, post tissue plasminogen activator (tPA), lumbar drain, external ventricular drains (EVD), postoperative transsphenoidal, subarachnoid hemorrhage (SAH) post bleed day 5	Telemetry, intracranial pressure (ICP) monitoring, arterial line, central venous pressure (CVP), q1-hour neuro checks	Cardiac and vasoactive medications (nicardipine, labetalol, diltiazem, esmolol)	Strengths: Clearly defined metrics for patient safety, nurse satisfaction, and patient satisfaction, inclusive of 13 similar units Limitations: quasi- experimental design with one group (no experimental or comparison group), other UHC hospitals already staffed at 1:3 in similar units, comparable units were not neuro-specific (they were surgical and cardiac units), input from other nurse managers could have been done as a survey, did not need to be an interview; no statistical analysis to show if correlations are significant	Increase in staffing yields decrease in falls with injury, staff turnover, and increases staff satisfaction. Increase to 1:3 ratio correlates with increased quality metrics within a neuroscience intermediate care unit. % of study hospitals with capabilities for: Postoperative craniotomy: 58% Post tPA: 25% Lumbar drain: 92% EVD: 75% Postoperative transsphenoidal: 25% SAH post bleed day 5: 25% ICP: 33% Arterial line: 58% CVP: 58% Q1-hour neuro checks: 25% Nicardipine: 50% Labetalol: 25% Diltiazem: 75% Esmolol: 25%

Author (s) (year); journal	Purpose	Unit name and structure	Design and level of evidence	Patient population	Monitoring capabilities	Drips and medications	Quality of Evidence	Statistics or implications
Tisnado, J. (2009); Journal of Nursing Administration	To describe the Neurosurgical Close Observation Room (NCOR) in terms of development, patient population, and management.	Neurosurgical close observation room (NCOR) 2 rooms, 3 beds per room Nurse-patient ratio not identified	Quality improvement report V	Postoperative craniotomy post 24 hours, externalized ventriculostomies, bypass grafting for moyamoya disease, transphenoidal hypophysectomy, implantation of deep brain stimulator, microvascular decompression, lumbar drains	No invasive monitoring "Frequent neurological assessment and intervention"	N/A	Strengths: Clearly stated patient population inclusion and exclusion criteria for NCOR Limitations: variables not clearly defined, no metrics for data pre and post development of NCOR, no reference to required nurse competencies; medications not defined	The use of NCOR is intended for patients that require frequent neurological assessment and intervention for changes in level of consciousness due to cerebral edema, vasospasm, confusion, agitation, and/or delirium. Nurses do not utilize invasive monitoring in NCOR.
Harding, A. (2009); Journal of Nursing Administration	To describe benefits of intermediate care units in terms of economic advantages and replacement of an aging nurse workforce.	Intermediate care unit (IMCU) 16 bed unit with 9 IMCU beds, and 7 telemetry beds Goal of 1:3 nurse-patient ratio, current is 1:2 to 1:4	Case report V	Noninvasive ventilators, recently extubated Population identified in admission criteria outlined in American Association of Critical Care Nurses (AACN) <i>Essential of Progressive Care Nursing</i> text	Telemetry No arterial lines	N/A	Strengths: identifies admission criteria outlined by AACN and admission criteria developed from Society of Critical Care Medicine intermediate care admission guidelines Limitation: IMCU is not neuro-specific, no previous comparable data, medications and monitoring not clearly defined	Intermediate care units should be considered as a solution to rising healthcare costs, emergency department throughput, and assurance of an adequate supply of educated critical care nurses. CPPD in IMCU is 60% reduction from the surgical ICU and 70% reduction from medical ICU IMCU is utilized as a ICU "farm league" or training ground for future ICU RNs

Author (s) (year); Journal	Purpose	Unit name and structure	Design and level of evidence	Patient population	Monitoring capabilities	Drips and medications	Quality of Evidence	Statistics or implications
Stacy, K. (2011); Critical Care Nurse	To discuss the typical patient population of a progressive care unit and associated nurse competencies required to care for such patients.	Progressive care unit Acknowledges that name and structure vary widely	Literature review, expert opinion V	Increased level of nursing care or increased level of surveillance; patients waiting for long term acute care (LTAC) placement; extensive wound management, extensive pulmonary interventions, weaning off ventilation, ventricular assist device, temporary pacemaker	Telemetry, arterial line, frequent neurological assessments, continuous pulse oximetry	Nitroglycerine, insulin	Strength: Defined progressive care, alternative names for progressive care units, and nurse core competencies are defined by the AACN, noted in the <i>Progressive Care Fact Sheet</i> Limitation: article is not neuro-specific	Progressive care units are recognized as a specialty as defined by the AACN Certification Corporation with the development of a specialty certification for progressive care nurses. Core competencies have been defined and identified. All progressive care nurses need to receive education and training to meet the AACN core competencies.
Schneider, M., Pomidor, M. (2014); Journal of Neuroscience Nursing	To demonstrate the efficacy of utilizing progressive care beds for a specific population of neurosurgical patients to positively impact patient care and outcomes.	Progressive care unit (PCU) Structure not identified 1:3 nurse- patient ratio	Retrospective descriptive, quasi- experimental study II	Post craniotomy, lumbar drains, ventriculostomy, cervical/thoracic laminectomy, subdural hematoma, pituitary tumors, transsphenoidal surgery, ventriculoperitoneal shunts	Telemetry, intracranial pressure, "advanced neuroassessment" No arterial lines, no intraventricular catheters with monitored pressure	No "medications not usually cared for on the medical- surgical telemetry unit per pharmacy protocols"	Strengths: Defined measurements of major variables, statistical analysis performed, neuro specific Limitation: study performed at single hospital with relatively small sample size, survey questions not validated, cost savings are approximate and consist of averages; admission criteria, monitoring, and medications not clearly defined	Post implementation of PCU, there was a significant decrease in the overall hospital LOS from admission to discharge. Average daily cost of ICU bed is \$2,725, compared to average daily cost of PCU bed, \$1,330. 30-day readmissions to hospital were 8 prior to implementation, 0 after implementation.

Author (s) (year); journal	Purpose	Unit name and structure	Design and level of evidence	Patient population	Monitoring capabilities	Drips and medications	Quality of Evidence	Statistics or implications
Alkhachroum, A., Benthoo, O., Chari, N., Kulhari, A., & Xiong, W. (2017); Journal of Clinical Neurology and Neurosurgery	To determine appropriate admission criteria for patients with intracerebral hemorrhage (ICH) to neuroscience step-down unit, avoiding intensive care admissions.	Step-down unit, dedicated stroke unit Structure not identified 1:4 nurse- patient ratio	Retrospective cohort study II	Supratentorial ICH, ICH volume < 20 cc, no intraventricular hemorrhage, systolic blood pressure < 200 mmHg, no respiratory failure, GCS > or = 12 No aneurysmal, arterial venous malformation, or traumatic hemorrhage	Q2 to q4-hour neurological assessments, q2- hour vital signs No arterial lines, no central venous pressure, no intracranial pressure monitoring No mechanical ventilation, no external ventricular drain monitoring, no intraventricular drains	Intravenous drips for blood pressure control No pressor therapy, no intravenous sedation	Strengths: statistical analysis performed for patient characteristics Limitations: retrospective data was gathered in one stroke center and based on that stroke center's step-down unit capability; study reflects singular neuro diagnosis	ICH patients that meet the following criteria can be safely admitted to a neuroscience step down unit (supratentorial ICH, ICH volume < 20 cc, no intraventricular hemorrhage, systolic blood pressure < 200 mmHg, no respiratory failure, GCS > or = 12). These criteria are based on one institution and should be cautiously applied to other hospitals and units.
Nates J. et al. (2016); Society of Critical Care Medicine (SCCM)	To update the SCCM guidelines for ICU admission, and discharge, and triage.	Intermediate medical unit (high- medium), level 2a Structure not identified 1:3 nurse- patient ratio	Clinical practice guideline IV	Noninvasive ventilation, postoperative patients, patients that do not want to be resuscitated or intubated	Q2 to q4 hour monitoring, telemetry	Intravenous infusions for blood pressure control (vasodilators), antiarrhythmics No pressor therapy, no arterial lines	Strengths: extensive literature review performed, expertise is clearly evident, revised recently Limitations: not neuro specific	"The existence and capabilities of [PCUs] vary greatly...evaluation of outcomes comparing care in these units to care in the ICU is incomplete. There is some evidence for success with weaning from mechanical ventilation...decreasing ICU bed utilization."

Appendix F: Patient Characteristics, Nurse Competencies, and Recommendations

Table F1
Patient Characteristics, Nurse Competencies, and Recommendations

Key: (-) not mentioned by source	Patient Characteristics		Nurse Competencies	Hospital A's NPCU	Recommendations
	Society of Critical Care Medicine guidelines (Nates et al., 2016)	Essentials of Progressive Care Nursing textbook (Chulay & Burns, 2010)	American Association of Critical Care Nurses guidelines (Stacy, 2011)	Neuro Progressive Care Guidebook (NPCU Guidebook, 2018)	Based upon literature review, included guidelines, and textbook
Monitoring					
Hourly Neuro Checks	No, 2-4 hours	Yes	-	Yes	Continue current hourly neuro checks
Continuous Pulse Oximetry	Yes	Yes	Yes	Yes	Confirm current competencies in recognition and management of patients requiring noninvasive oxygen delivery, and continuous and intermittent monitoring of oxygen saturation
Cardiac or Telemetry	Yes	Yes	Yes	Yes	Confirm current competencies in cardiac monitoring techniques, basic dysrhythmia interpretation, and lead placement
Intracranial Pressure (ICP)	-	Yes	-	No	Consider adding new competency for monitoring ICP wave forms and values
Arterial Line	No	Yes	Yes	No	Consider adding new competency for management and recognition of instability related to invasive arterial pressure monitoring and values
Diagnoses or Intervention					
Ischemic Stroke	-	Yes, unclear timeframe	Yes	Yes, 12 hours post tPA	Confirm competencies in assessment, monitoring, and management of patients with a stroke diagnosis
Hemorrhagic Stroke	-	Yes, unclear timeframe	Yes	-	Confirm competencies in assessment, monitoring, and management of patients with a stroke diagnosis
Subarachnoid Hemorrhage	-	Yes, 24-48 hours post intervention	-	Yes, time varies	Confirm competencies in assessment, monitoring, and management of patients with a stroke diagnosis
Interventional Radiology (IR) Procedure	-	Yes, 24-48 hours post intervention	-	Yes, unclear time	Confirm current competencies and consider defining additional competencies for specific IR procedures; i.e. colling compared to sheath
Unstable Neurological Disorders (Guillain-Barre, Multiple Sclerosis, Myasthenia Gravis, Seizure Disorders)	-	Yes	Yes, seizure disorder specific	-	Consider adding new competency for assessment, monitoring, and management of patients with unstable neurological disorders, specifically seizure disorders
Postoperative Craniotomy	-	Yes	Yes	Yes	Confirm current competencies in assessment, monitoring, and management of patients both pre and post craniotomy, and cranioplasty

Key: (-) not mentioned by source	Patient Characteristics		Nurse Competencies American Association of Critical Care Nurses guidelines (Stacy, 2011)	Hospital A's NPCU Neuro Progressive Care Guidebook (NPCU Guidebook, 2018)	Recommendations Based upon literature review, included guidelines, and textbook
	Society of Critical Care Medicine guidelines (Nates et al., 2016)	Essentials of Progressive Care Nursing textbook (Chulay & Burns, 2010)			
Postoperative Ventriculoperitoneal (VP) Shunt	-	Yes	-	Yes	Confirm current competencies in assessment, monitoring, and management of patients both pre and post VP Shunt, confirm addition of EVD management competency
Subdural Drain	-	Yes	-	Yes	Maintain current competency in assessment and management of drain
Lumbar Drain	-	Yes	Yes	Yes	Consider adding ability to monitor transduced and continuous lumbar drains, confirm current competency in assessment and management of drain
External Ventricular Drain (EVD)	-	Yes	-	No	Consider adding new competency for monitoring and management of EVD and associated ICP monitoring
Mechanical Ventilators	No	Yes	Yes	Only for spinal cord injury wean	Maintain exclusion criteria and unique inclusion of spinal cord injury wean, consider adding new competency specific for tracheostomy care, and assessment of ventilator-dependent patient
Infusions					
Nicardipine	Yes	Yes	-	Yes	Maintain current competency regarding titration, recognizing value of invasive blood pressure monitoring via arterial line competency
Hypertonic Saline	Yes	Yes	-	Yes	Consider adding new competency for monitoring and titration of hypertonic infusion for both sodium management and ICP management
Vasopressors	-	No	-	No	Maintain exclusion criteria
Insulin Infusion	-	Yes	Yes	Yes	Confirm current competency for titration of insulin infusions
Nurse-to-Patient Ratios	1:3	-	-	1:3	Maintain current 1:3 ratio, and consider 1:2 ratio with new competencies, pending patient stability and presence of drains, infusions, or invasive blood pressure monitoring

Nursing**Capstone Report Approval Form****Master of Science in Nursing – MSN****Milwaukee School of Engineering**

This capstone report, titled "Comprehensive Review of a Neuro Progressive Care Unit," submitted by the student Abigail Vogt, BSN, RN, has been approved by the following committee:

Faculty Advisor: Havilah Normington Date: 11/30/18

Dr. Havilah Normington

Faculty Member: Rhonda L. Powell Date: 12/3/18

Prof. Rhonda Powell